



University of Idaho
College of Engineering

CAUTI-PREVENTING URINARY CATHETER

TEAM INFECTION PROTECTION

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INNOVATIVE CATHETER COULD PREVENT INFECTION AND SAVE LIVES



80% of catheterized patients develop a CAUTI

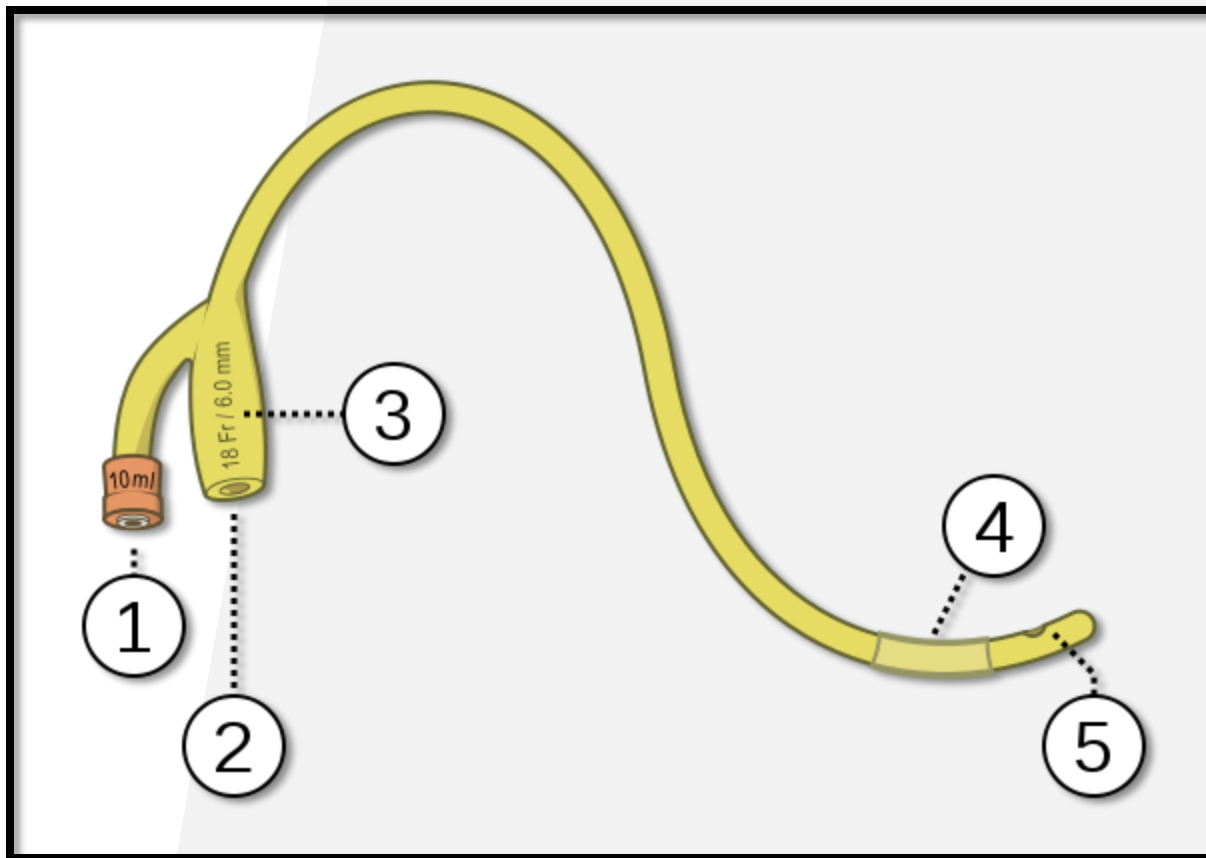


13,000 deaths every year



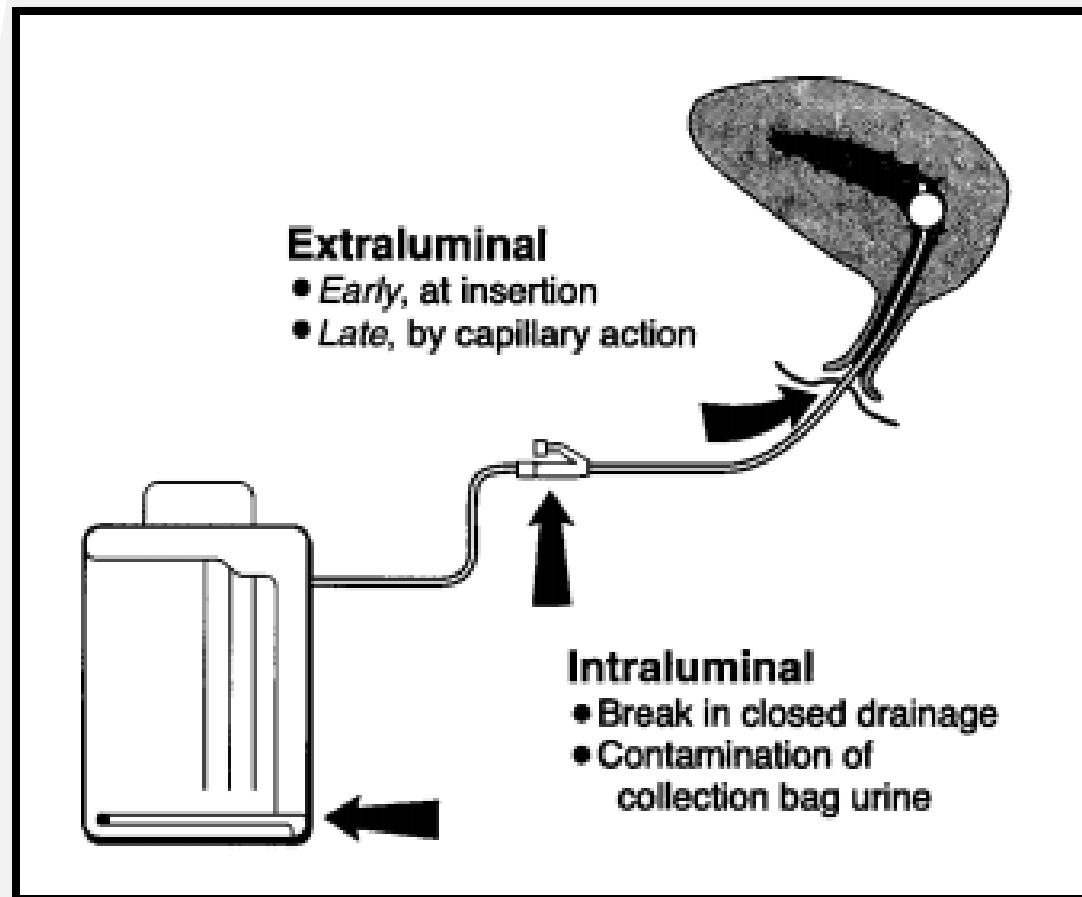
> \$400M increased cost to hospitals

ANATOMY OF THE URINARY CATHETER



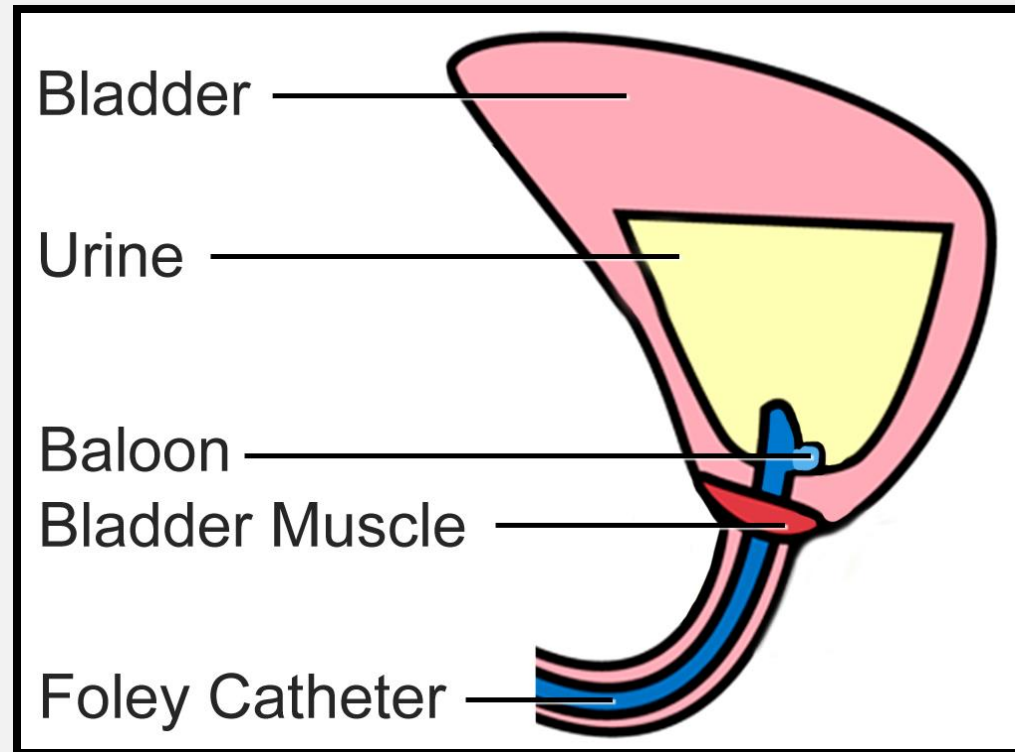
1. Balloon Port
2. Urine Drainage Port
3. Catheter Size (Fr scale)
4. Balloon
5. Bladder Opening

FOCUSING ON THE ROOT CAUSE OF THE CAUTI

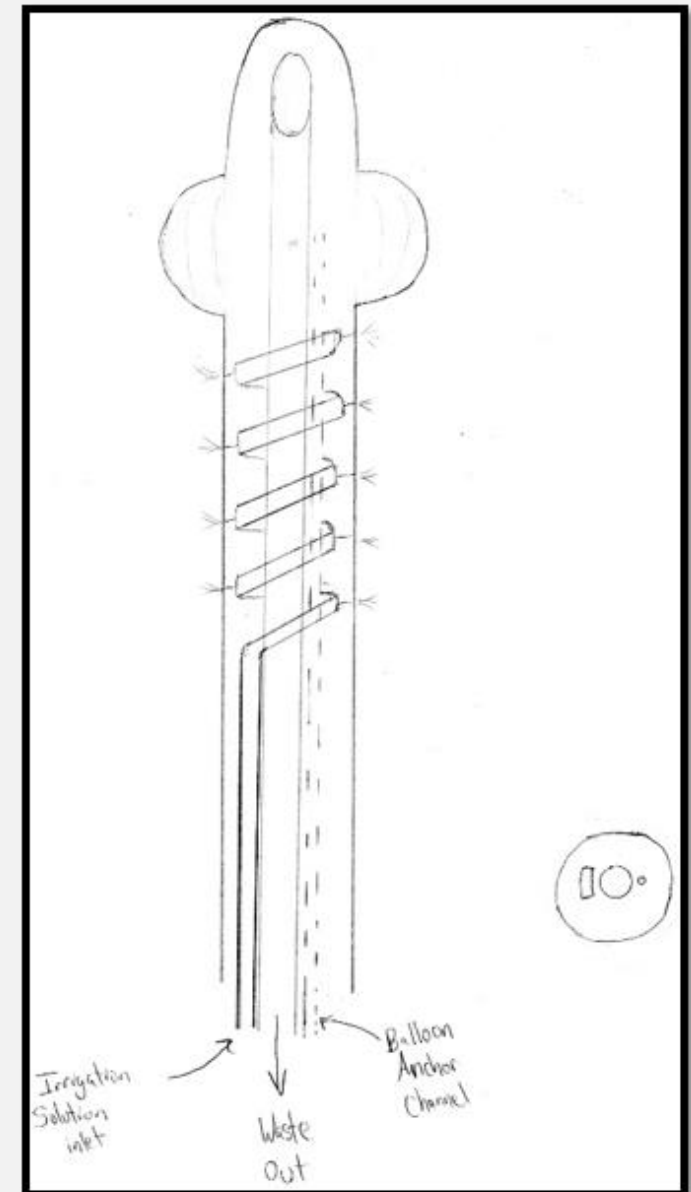
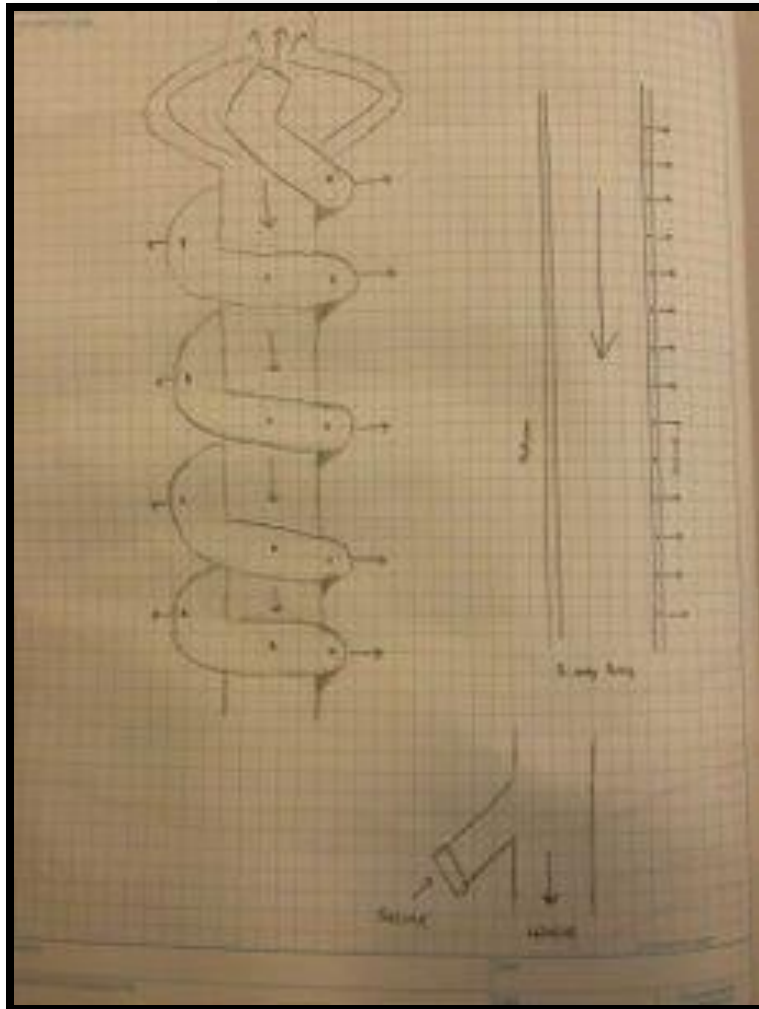


DESIGN GOALS

- I Perform the functions of the common Foley catheter
- I Ability to irrigate urethra to flush bacteria
 - Mimics natural function
- I Design shall be adaptable to range in size from 12–24 Fr. (1 Fr.= 1/3 mm)



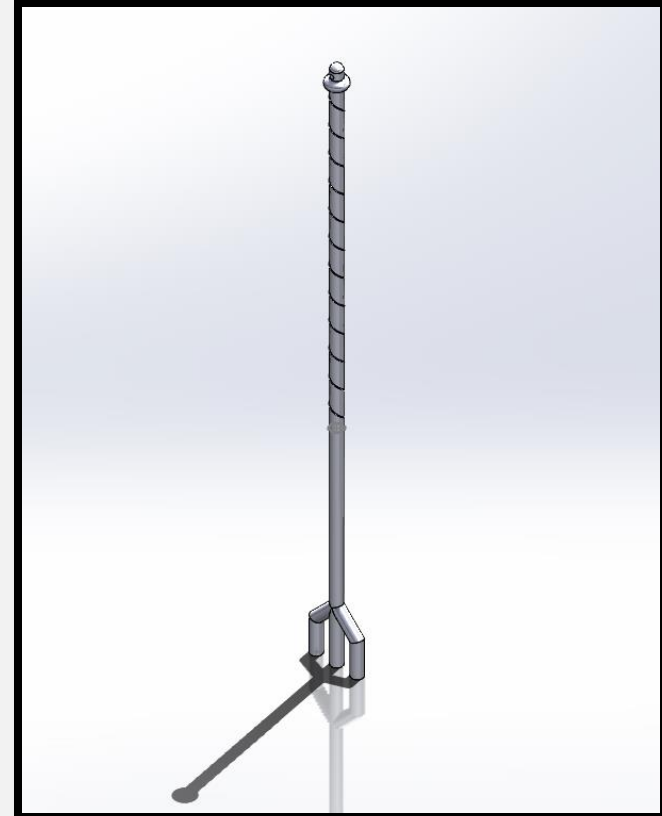
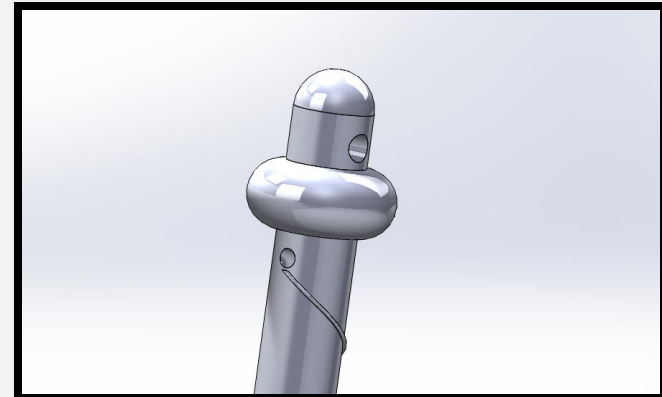
EARLY DESIGN CONCEPTS



CHOSEN DESIGN: PRECAUTION Catheter

OUTER SPIRAL FOR SPACING

- I 3 straight internal channels
- I 1 outer spiral, to create space between tight urethra walls
- I Pros:
 - Creates space for fluid to flush urethra
 - Mimics natural function of urethra
 - Subtle but effective design change
- I Cons:
 - Possible discomfort to patient



DESIGN DEVELOPMENT AND PROTOTYPING



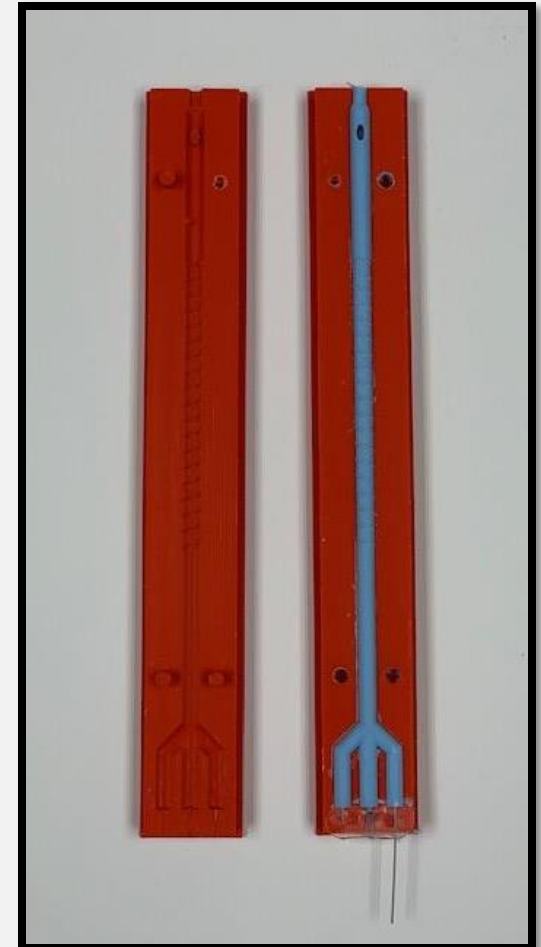
I Liquid Latex “dipping” to
create features layer-by-layer



I 3D printing catheter with
flexible TPU material

SIMPLE DESIGN ENSURES MANUFACTURABILITY

- I Mold can be made and replicated
- I Production consists of the same steps to used in the industry

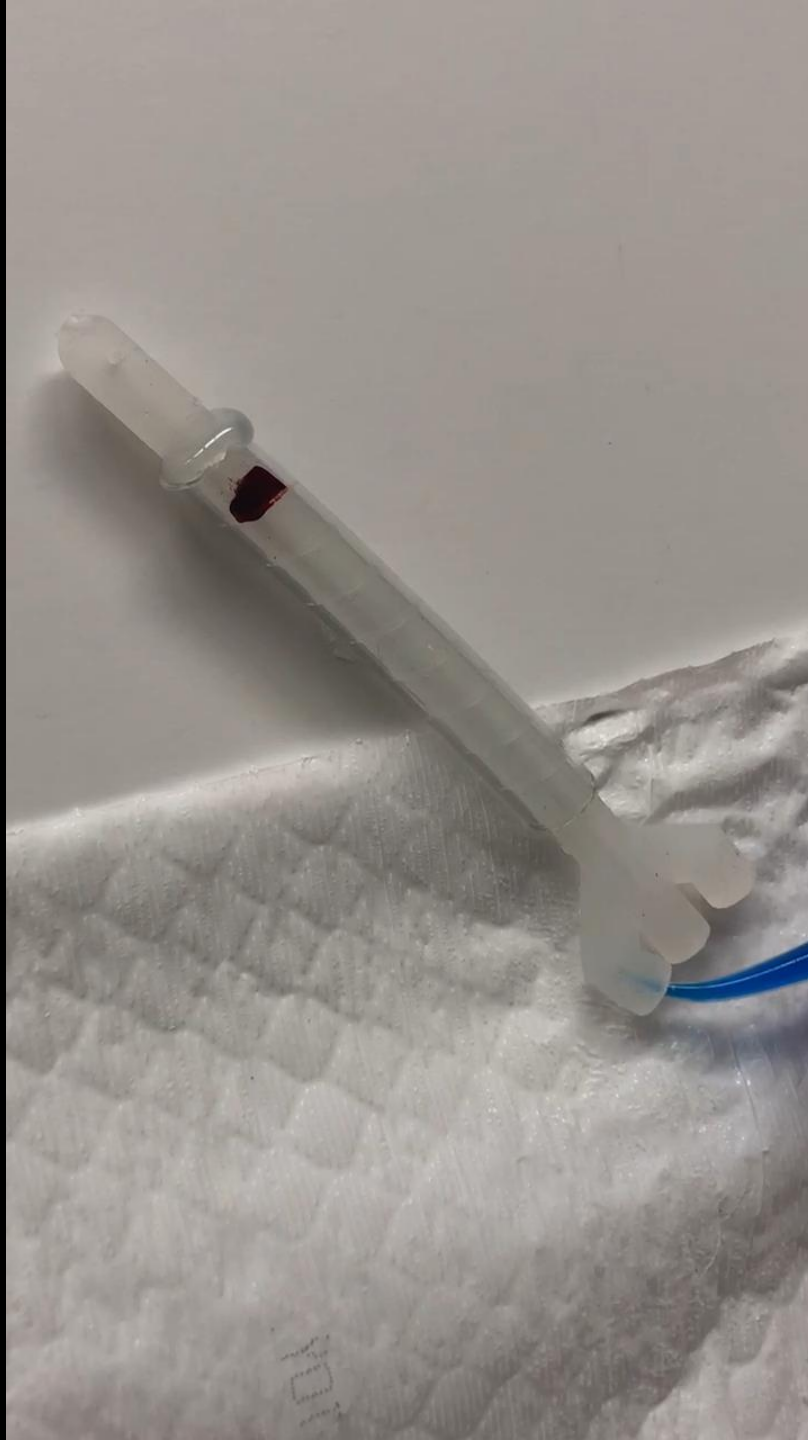




PROOF OF CONCEPT FLOW TESTING

- I Red dye represents bacterial growth
- I Blue dye represents saline flowing through the urethral walls
- I Demonstration presents how "bacteria" is flushed between the catheter surface and urethra wall

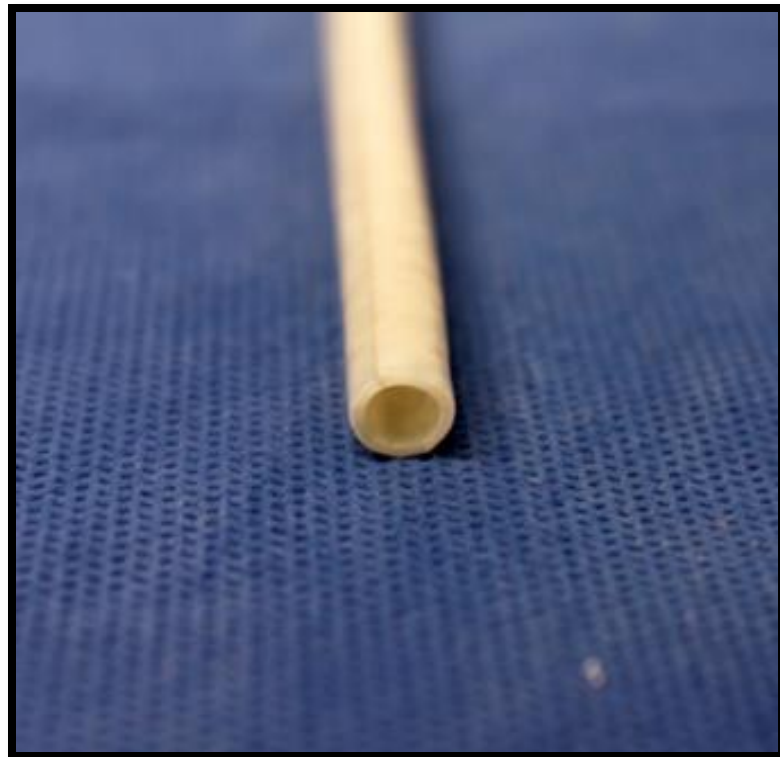






BACTERIA TEST SET UP

- I Irrigation ability tested using live e. Coli
- I Simulated human body environment
- I E. Coli growth on nutrient agar after 6 days



REGULAR FLUSHING SHOWS SIGNIFICANT DECREASE IN BACTERIAL GROWTH

FOLEY CATHETER



**SPIRAL CATHETER,
FLUSHED DAILY FOR 6 DAYS**

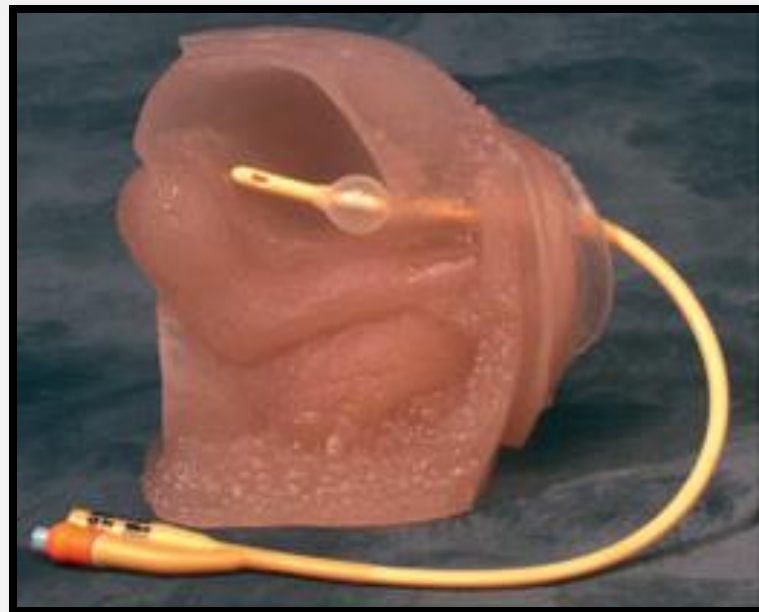


PATIENT USABILITY TESTING METHOD

I < 1.12 lbf (5N) of force to allow for atraumatic insertion

- “Urethral catheter insertion forces: a comparison of experience and training”

I Tested with lifelike catheterization model



FORCE OF INSERTION SUGGESTS RELATIVELY ATRAUMATIC EXPERIENCE

**REGULAR CATHETER,
18FR (6MM OUTER DIAMETER)**

0.17 lbf

**SPIRAL CATHETER,
6MM TOTAL OUTER DIAMETER**

0.303 lbf

OVERALL CONCLUSIONS

- I Design can remove harmful bacteria from tight urethral space
- I Provides a relatively atraumatic insertion, with potential to make removal very simple
- I Can be easily manufactured based on current practices
- I Solid proof of concept- still lots of testing needed



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